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Waste Reduction Assistance Program (WRAP): On-Site Consultation Audit Report Manufacturing/Distributing Company

Alaska Health Project, Anchorage

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This study reports on one manufacturing/distributing company. The study makes recommendations for the reduction of hazardous waste for this company and for others in the industry on areas like recycling and chemical storage.

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Alaska Health Project

WASTE REDUCTION ASSISTANCE PROGRAM (WRAP)

ON-SITE CONSULTATION AUDIT REPORT

MANUFACTURING/DISTRIBUTING COMPANY

JUNE 1, 1988

431 West Seventh Avenue - Suite 101 - Anchorage, Alaska 99501 - (907)276-2864

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
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READERS NOTE:

The information contained herein is intended to be general guidance for the facility described in this report and the industry as a whole. It is the product of approximately 6 to 8 hours of on-site consultation. The focus of the report is waste management and waste reduction, not regulatory compliance. Regulatory issues mentioned herein are discussed only insofar as they impinge on management issues related to hazardous waste management and waste reduction, and are not part of a comprehensive discussion about all pertinent regulation requirements. Waste determinations were made from available data, no on-site sampling took place. Managers interested in specific information on hazardous waste regulations should contact the nearest EPA or Department of Environmental Conservation office. Waste reduction measures are described briefly and should be further evaluated and balanced against unique conditions of each specific business.

TABLE OF CONTENTS

Introduction	1
Waste Reduction Assistance Program (WRAP)	1
Audit Methods	2
Plant Operations	4
Bottle Making	4
Windshield Wiper Fluid	6
Chemical Storage	6
Waste Generation	8
Bottle Making	8
Windshield Wiper Fluid	8
Chemical Storage	10
Hazardous Materials Management	11
Waste Storage	11
Costs	12
Waste Reduction	16
Incentives	16
Categories	16
Plant Wide	17
Cardboard Flats	18
Bottle Making	18
Windshield Wiper Fluid	19
Chemical Storage	20
Feasibility Analysis	22
Bottle Making	22
Windshield Wiper Fluid	22
Chemical Storage	23
Conclusion and Summary	24

INTRODUCTION

WASTE REDUCTION ASSISTANCE PROGRAM (WRAP).

The Waste Reduction Assistance Program is designed to assist small businesses reduce their industrial wastes through educational programs and on-site waste audits. The program is funded by a RCRA 8001 grant awarded by the United States Environmental Protection Agency (EPA) to the Alaska Health Project, a non-profit organization located in Anchorage, Alaska. The Waste Reduction Assistance Program reduces wastes through on-site technical assistance audits.

After on-site audits are conducted, individual reports are written describing the processes used and wastes produced by the particular business. Each report then recommends methods for reducing these wastes. The audits emphasize waste reduction through source reduction techniques and recycling. The identity of the business remains confidential. The audits are intended to be applicable to other similar businesses in Alaska. Audit reports are available to interested parties upon request.

This report is the result of an audit of a small manufacturing/distributing company. The purpose of the report is to:

1. Identify the wastes produced in the manufacturing of plastic bottles, windshield wiper fluid, and chemical storage and the processes by which they are generated.

2. Make recommendations for methods to reduce the amount of waste generated.

3. Identify common waste management practices and advise on methods to improve the storage and shipping of hazardous waste.

4. Analyze the cost benefits of selected waste reduction strategies recommended.

5. Provide an example to other manufacturers of similar products of how to conduct a waste reduction audit.

All recommendations, information, and cost data included in this report are subject to change with changing market conditions, regulatory climate, and shop processes. This report is written for a specific Alaskan business; it offers only general guidance to other small quantity generators.

AUDIT METHODS

The audit team included an environmental engineering graduate student intern and an environmental health specialist. The audit was performed in two steps: a preliminary interview with the shop foreman and a shop walkthrough. The interview collected the following information:

1. General shop information (size, layout, etc.)

2. Shop processes

3. Material safety data sheets.

4. Current waste management practices.

During the interview, the audit team explained the audit process to the shop foreman.

In step two, the shop foreman and the audit team conducted an inspection of the shop operations and processes. The audit team identified the processes with the potential for generating waste and investigated the shop's waste management practices.

The six hours of on-site audit included no environmental sampling or industrial hygiene monitoring. All the information provided in this report is based on the interview, the walkthrough, and a literature review. Any hazardous waste determinations are based upon existing laboratory reports. Waste volume figures were based upon estimates made by the generator and the audit team during the shop walkthrough. The audit report was written by the graduate student with guidance from Alaska Health Project and University of Alaska at Anchorage School of Engineering.

PLANT OPERATIONS

The main plant operations include production of plastic bottles and windshield wiper fluid, filling plastic bottles with windshield wiper fluid, and chemical storage. Minor operations include production and distribution of purified and distilled water, Ice Melt, anti-freeze, and specialty chemicals. This report will concentrate on the main plant operations.

The plant size is approximately 8000 square feet, which includes office space, a bottle making room, a windshield wiper fluid filling area, and chemical and bottle storage (Figure 1). Outside the building are four 14,000 gallon tanks, one 2,000 gallon, one 700 gallon, and one 600 gallon tank. One of the 14,000 gallon tanks is used to store methanol, another to store glycol, and the others contain windshield wiper fluid. The smaller tanks are used for mixing, not storage. Following is a description of the major processes in the facility.

BOTTLE MAKING

Plastic bottles are made out of polyethylene and shaped by a blow molder. Three types of bottles are made at the plant: gallon dairy bottles, gallon industrial bottles, and quart industrial bottles.

The blow molder is set up to recycle. It is equipped with chutes containing forced air to pull the trimmings into a hopper where they reenter the feed stock. There are doors on the recycle chutes where waste polyethylene can be inserted for recycle.

The plastic enters the blow molder as small polyethylene beads. The beads are ground and heated, and the plastic is piped to the extruder where it flows into molds. Then the bottle is mechanically placed onto a conveyor belt. The bottles cool rapidly while on the conveyor belt. If the bottles miss the

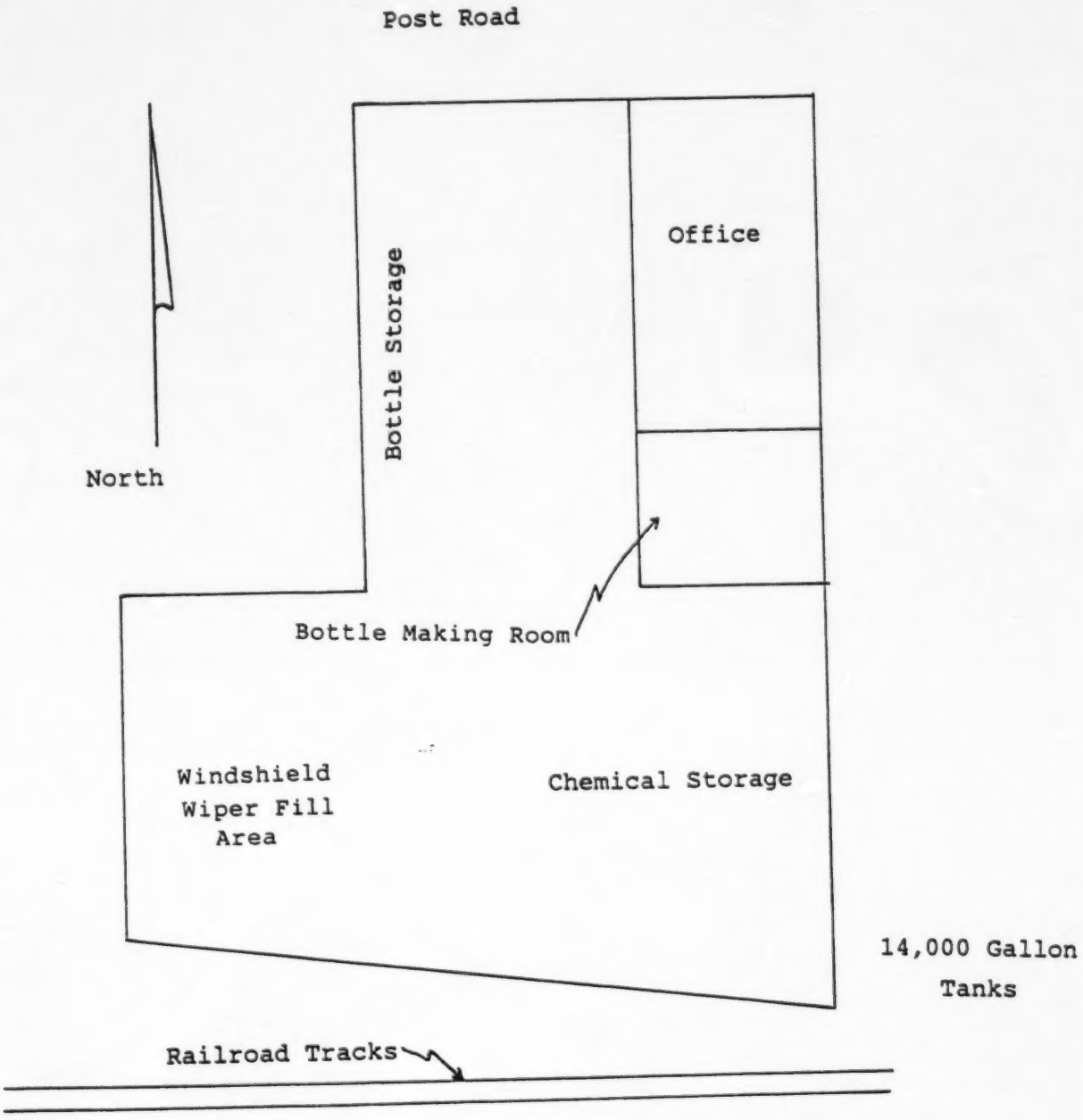


Figure 1
Partial Schematic Diagram of Plant

slots on the conveyor belt, they lose their shape and are no longer useable. Next, the bottles fall onto another conveyor belt where they are trimmed and checked for air holes. Trimmings automatically fall into recycle chutes. Uncontaminated, unusable bottles are pushed into recycle chutes. Two slugs of plastic are extruded each time the machine starts up, each weighing approximately five pounds. Unusable waste is generated when the bottles falls on the floor, becoming contaminated with dirt and grime.

WINDSHIELD WIPER FLUID

The windshield wiper fluid (methanol, water, surfactant [ammonia], and dye) is mixed outside in a 14,000 gallon tank. The mixture is then piped into the shop and into an automatic filling and capping machine. Windshield wiper fluid is put into gallon plastic bottles.

CHEMICAL STORAGE

Approximately 50% of the plant space is used for chemical storage. Plastic bottles are stored on the floor, and stacked up to the ceiling. Chemicals are stored on the floor or on shelves in bags, buckets, or 55 gallon drums.

Chemicals are either stored on shelves or on the floor. The shelves are bolted to the floor and extend to the ceiling with three or four storage levels. The shelves are organized based on the size and shape of the container. Chemical compatibilities are unknown.

Chemicals include water treatment chemicals used by the Municipality of Anchorage, old janitorial supplies, and a variety of miscellaneous chemicals. Water treatment chemicals are stored on the floor. Some lifts are separated by pallets while others are separated by cardboard splits. Pallets are often beneath 55 gallon drums to ease in moving them. The base of the 55 gallon drums sometimes hang over the edge of the pallets and the drums are not secured to the pallets.

Janitorial supplies are no longer sold by the company. Stock on hand is excess order and is waiting to be sold. The supplies are generally stored in five gallon buckets and case lots. Not all the containers are sealed.

Other stored chemicals have been used in the preparation of specialty chemicals. Most are stored on shelves or on pallets. Containers include bags, five gallon buckets, or 55 gallon drums. Not all of the containers are labeled; some of the bags are ripped, and not all the containers are sealed. Storage is unordered. Stock in 55 gallon drums which is not stored on shelves is moved around.

WASTE GENERATION

Wastes are generated in the bottle making process, during filling of the bottles, and the moving and storage of chemicals. Each process generates its own characteristic waste.

BOTTLE MAKING

Primary waste generated is plastic. Plastic waste is generated in the following ways:

1. Five pound plastic slugs are generated during start up and/or change over of the blow molder. Start up/change over occurs every two to three weeks.

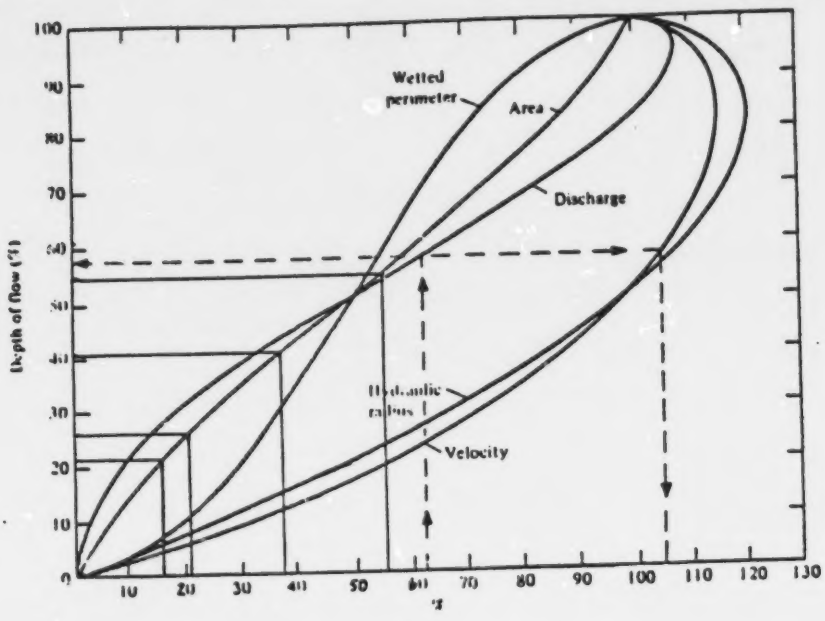
2. Plastic waste associated with imperfect molding ends up on the floor. During the audit, waste bottles were generated at a rate of approximately 15 to 20 bottles per hour.

3. Plastic that has fallen on the ground and becomes contaminated with grit and grime cannot be recycled.

WINDSHIELD WIPER FLUID

Most of the waste is generated by the filling machine. Waste product ends up on the floor where it is diluted with water and washed into the city sewer.

The windshield wiper fluid is 50% methanol which is a regulated substance. The waste product is generated during the filling process. No waste is generated which has to be stored on site prior to proper disposal. Calculations based on three fill sessions estimate an average of 5% (Figure 2) of the product is wasted and washed down the drain into the city sewer.



Depth of Flow (%)	% Area Full	% Removed from Storage Tank	Gallons Packaged	Gallons Removed	Gallons Lost
66/120 = 55	56	100-44-38 = 18	2509	2590	82
49/120 = 41	38	100-62-22 = 16	2185	2302	118
33/120 = 27	22	100-78-18 = 4	485	576	91
26/120 = 22	18				

Total Removed: 5468 gallons Total Lost: 291 gallons

Percent Lost: 5%

Figure 2
Calculations of Product Waste
from the Fill Machine
(Viessman and Hammer, 1985)

Spills occur when the storage reservoir in the fill machine overflows, when the fill machine over fills the bottles, and when the capper doesn't hit the center of the bottle.

1. The storage reservoir of the fill machine is filled by a pump. Overflow occurs because the float which regulates the pump is not synchronized with the rate at which the pump fills the tank, therefore, windshield wiper fluid spills onto the floor.

2. Bottles are placed in slots on a conveyor belt and are filled as they travel along the conveyor. The filler can overfill the bottles. Excess falls on the floor.

3. An automatic capper seals the bottles. The capper doesn't always find the center of the bottle and the bottles can be tilted or squashed during the capping process. Spillage ends up on the floor.

4. After the bottles are filled and capped they go onto another conveyor belt where the fill levels and cap tightness is checked and they are prepared for shipment. When a lot of bottles stack up on the conveyor belt the pressure between them can build up to a point where caps get squeezed off, spilling product on the floor.

CHEMICAL STORAGE

Due to a lack of storage area in the plant, chemicals and products are moved around the shop to make room when more storage is needed or when specific storage needs access. Shelf contents include janitorial supplies and other chemicals of unknown composition.

Floor storage is a problem since space is at a premium, and it is often necessary to store large quantities of bottles and windshield wiper fluid.

HAZARDOUS MATERIALS MANAGEMENT

WASTE STORAGE

A small quantity generator may not store hazardous wastes in quantities greater than 13,200 pounds for longer than 180 days. The waste may be stored for 270 days if it has to be transported over 200 miles to a licensed hazardous waste facility. This provision applies to Alaska, which has no approved hazardous waste disposal facility. Generators of less than 220 pounds per month of hazardous wastes are subject to the Small Quantity Generator Regulations if they store more than 2,200 pounds of hazardous wastes.

Hazardous wastes containers should be clearly labeled "HAZARDOUS WASTE". The containers should also be marked with the beginning date of collection. The containers should be kept in good condition, closed, and inspected once per week. The wastes, if ignitable or reactive, should be placed as far as possible from the storage's property line. The wastes may be treated on-site without a permit if:

A) They are treated within 180 days (in Alaska, 270 days).

B) The containers conform to the regulation described in the above paragraph.

C) Steps are taken to prepare for and prevent accidents as described in the Small Quantity Generator Regulations.

Precautions should be taken to prevent accidents involving the hazardous materials stored on site. The regulations for the storage of hazardous materials and wastes were written to prevent accidental spill, fires, explosions, and release to the environment. The operator of a site should develop a contingency plan to deal with accidents involving the hazardous wastes being stored.

Generally, there are three acceptable disposal methods for hazardous wastes:

A. Disposal in a licensed hazardous wastes landfill.

B. Disposal in an authorized high-temperature incinerator.

C. Disposal to an authorized hazardous waste recycler.

None of these facilities are available in Alaska and all wastes must be transported to a disposal site approved by the Environmental Protection Agency (EPA). The wastes must be shipped in containers and by haulers as prescribed by the Department of Transportation (DOT). A hazardous waste hauler should be able to offer assistance in assuring adequate packaging. The packaging requirements are described in the DOT regulations (49 CFR Part 172).

COSTS

The cost of disposing hazardous wastes can vary with the following factors:

A. Quantity and nature of the waste.

B. Transportation distance.

C. Variations in process charged by the haulers and disposal facilities for the transportation and disposal of the hazardous wastes.

It may be advantageous to contact other generators of hazardous wastes to coordinate shipments and realize savings through bulk shipments. Waste determination fees may be eliminated if future waste streams remain constant.

In Alaska, there are no EPA approved hazardous waste management facilities. All hazardous wastes, as defined by RCRA, must be shipped out-of-state to an approved facility. The cost of shipping the hazardous waste increases the disposal costs considerably.

Comprehensive disposal costs for a 55-gallon drum of hazardous wastes generated in Alaska can cost up to 1,390.00 (Glean Incorporated). See Table 1 for a cost breakdown. This is a very generalized estimate which assumes incineration as the ultimate disposal method. If the waste is place in a landfill (approved for hazardous wastes by EPA), or by recycling, costs may be reduced. Also, as noted previously the cost can vary depending upon the hauler and the disposal facility.

The high disposal cost of hazardous wastes should be taken into consideration when purchasing raw materials and planning expenditures. Production processes and methods should also be analyzed to identity means of minimizing the generation of hazardous wastes and thereby disposal costs.

Table 1

Hazardous Waste Disposal Cost Estimate for One 55-Gallon Drum Generated in Alaska

Waste Determination (In state lab analysis)	$ 175.00
Transportation	$ 310.00
Disposal Site Profile (On site lab analysis)	$ 200.00
Waste Acceptance	$ 125.00
Incineration	$ 580.00
Total Cost	$1,390.00

The wastes investigated during the audit are not hazardous wastes as defined by the Environmental Protection Agency (EPA) except methanol.

Currently it appears that the methanol discharge is excluded from Resource Recovery and Conservation Act (RCRA) regulations pursuant to 40 CFR 261.4 (A) (1) (ii) (domestic sewage exclusion). However, the discharge must meet local requirements for discharge into the sewer system. Failure to meet these requirements would result in the need to dispose of methanol waste in a different fashion.

The methanol waste may also be excluded under part 261.3 (D) relating to "de minimus" losses from manufacturing operations. However, it remains questionable how EPA would interpret or define the losses from the fill tank reservoir.

Through better recycling and process management the company could save money as well as reduce the load on the sanitary landfill and sewer system.

WASTE REDUCTION

INCENTIVES

The private sector has many incentives to reduce their hazardous wastes; they include the following:

1. High disposal costs: strict hazardous waste legislation and high liability lead to disposal costs that are increasing every year.

2. Financial liability: Generators of hazardous wastes are liable for their wastes from their production to their ultimate disposal. This liability includes potential improper handling by the transporter or the disposal facility, as well as any future sudden releases of disposed wastes. By reducing wastes, generators reduce their liability.

3. Public relations: Hazardous waste is now a very visible issue; employing waste reduction can better a business's public image.

4. Savings of raw materials.

5. Improved safety and health conditions.

CATEGORIES

The production of wastes can be reduced in many ways. The most effective way to reduce wastes is to reduce the use of the processes and raw materials that create them. Source reduction and waste recycling are treatment methods effective to reduce wastes. Wastes which cannot be recycled should be treated on site to reduce the toxicity; or as a last option, sent to a disposal facility.

Waste reduction techniques can be grouped into the following categories:

1. Process Modification: The use of technology to reduce wastes. For example, redesigning equipment or production lines to produce less waste.

2. Improved Plant Operations: Changes in plant operations that decrease wastes. For example, improved chemical storage to prevent spills.

3. Production Process Changes: Utilizing raw materials that will produce less waste.

4. Recycling and Reuse: Recycling potential wastes back into the production process. For example, regrinding polyethylene clumps generated at the start up of operations.

WASTE REDUCTION OPTIONS FOR THIS PLANT

PLANT WIDE OPTIONS

Waste reduction through source reduction and recycling can offer economic benefits to a company through cost savings, reducing regulations, and treatment costs. This facility is encouraged to investigate waste reduction opportunities more fully. In general the plant could identify and enhance waste reduction plant-wide by:

1. Inventorying all chemicals and raw materials on a regular basis to ensure against leaks and spills.

2. Implementing formal employee training procedures to ensure proper operation and maintenance of plant process equipment. In addition employees should receive proper training in hazardous materials management and waste reduction to practice waste reduction.

3. Conducting periodic waste audits to maintain plant efficiency, waste generation, and waste reduction.

4. Evaluating current and future storage needs to ensure adequate space to increase plant efficiency and reduce potential for losses.

5. Forming an in-plant waste reduction team to monitor the effectiveness of waste reduction options and identify additional possibilities.

CARDBOARD FLATS

Cardboard flats are used in the storage of plastic dairy bottles. The cardboard flats are recycled. Recycled flats are used in the storage of industrial bottles.

BOTTLE MAKING

Polyethylene used in the production of plastic bottles is a non-boidegradable compound. It is recyclable. By increasing the amount of raw material recycled money is saved through less loss of product and lowered solid waste disposal costs.

Improved plant operations offer low cost waste reduction opportunities for the bottle making process. To prevent the contamination of the plastic and to enhance recycling the following recommendations are suggested:

1. Operate and maintain the blow molder at optimum efficiency to reduce the amount of plastic which could possibly become contaminated with dirt and grime.

2. Place clean baskets near locations where imperfect bottles are removed from the production line (by the extruder, and where the bottles change conveyor belts). The baskets would temporarily store plastic until the operator had the time to put the plastic into the recycling chutes.

3. Research the feasibility of installing additional recycle chutes.

4. Keep accurate records on plastic lost and recycling savings.

Air quality around the grinder and in the bottle making room may exceed the standards for particulates. This can be determined through air sampling and analysis. A large pile of polyethylene shavings was noted around the grinder as well as a plastic taste noted in the bottle making room during the audit.

WINDSHIELD WIPER FLUID

Most of the waste associated with the windshield wiper fluid is generated by the fill machine (fill reservoir overflowing, bottle overfilling, and miss capping). Several improvements can be made to the fill machine process to enhance waste reduction.

Currently the shop does recycle some lost material in this process. Leaking bottles of windshield wiper fluid are removed from the production line and used to "top off" other containers to maintain a constant fill level in all the bottles. Additional waste reduction can be achieved through equipment modifications, improved operation, and recycling.

1. Overflow losses from the fill machine reservoir can be controlled by installing a sensitive float system which will only allow the reservoir to fill to a specified level.

2. Losses associated with the capper could be controlled by installing new equipment. However this does not meet the needs of the facility owner. It is recommended that a catch basin be installed to collect spillage. The product could be recycled back into the fill reservoir.

3. Extension of the conveyor rack and rapid removal from the belt would help avoid spills in this aspect of the process.

4. Additional monitoring of actual losses should be performed to determine cost savings for waste reduction technology.

The concentrations of methanol and ammonia in the air may exceed health standards. Air sampling and analysis should be performed to ensure compliance. A strong ammonia smell was noted during the audit.

CHEMICAL STORAGE

Chemical storage does not directly produce waste. The limited space and constant moving of the chemicals create an environment with a high spill potential, which can result in waste generation. Another event which could initiate spills is earthquakes. Inventory management and improved plant operations offer waste reduction opportunities for chemical storage. Specific recommendations include the following:

1. Reduce the amount of movement of chemicals/product.

2. Ensure incompatible chemicals are not stored near each other. For instance, when ammonia and chlorine are combined a toxic gas is formed.

3. Provide safe stable storage environments for all stored inventory. Methanol is dangerous when exposed to heat, flame, or oxidants.

4. Earthquakes are unpredictable and uncontrollable. Care must be taken to ensure stability of storage facilities. The shelves are bolted to the floor, since they reach the ceiling they could also be bolted to the ceiling. Heavy materials should be kept on lower levels. Reactive and incompatible chemicals should be identified to avoid dangerous combinations in the event of an earthquake.

5. An old stock associated with previously distributed janitorial supplies should be sold or exchanged to make room for current stock and avoid problems associated with outdated stock or hazardous combinations of compounds.

6. Current stock should be ordered on an as needed basis. Reviewing past stock and order records may help in projecting future needs.

7. One potential spill problem is associated with the constant movement of chemicals and product stock in the plant. The limited space requires the constant shuffling of product and stock to assure accessibility to specific items at specific times. The practice increases the chances for spills.

8. Evaluate storage needs and inventories, including future projections. Additional space may be warranted.

FEASIBILITY ANALYSIS

BOTTLE MAKING

Gallon bottles contain approximately 63 grams of polyethylene. Every two to three weeks, two five pound clumps of waste polyethylene are generated. At an approximate cost of $0.50 per bottle, $36.00 worth of raw material is lost. An additional loss of 15-20 bottles were wasted during the audit. This yields a raw material loss of $5,400.00 to $6,300.00 per month assuming 24 hour a day 7 day per week production, and waste generation rates similar to those observed during the audit.

Plastic laundry baskets cost about $5.00 apiece. If four were placed around the blow molder and molded bottle loss was cut by 50%, the cost of the baskets could be realized in one hour.

WINDSHIELD WIPER FLUID-FILL MACHINE

The problem off overfilling the reservoir in the fill machine can be resolved by installing a more sensitive float system which will shut the pump off prior to overflow. According to Dice Pump and Well Supply and Alaska Pump and Supply these systems are available for under $50.00. The price of the float system would be paid for by the savings in product from one fill session.

If this is not feasible a collection reservoir to trap overflow from fill machine processes should be considered. Given the currently calculated product loss, the payback period could be relatively short.

CHEMICAL STORAGE

Recommended waste reduction options for chemical storage can be implemented at little cost. Most recommendations involve management and procedural changes.

CONCLUSIONS AND SUMMARY

The waste streams investigated during this audit are not regulated as hazardous waste. This plant does produce and store hazardous materials.

This plant already actively recycles some of its waste. Cardboard flats are reused, leaky bottles of windshield wiper fluid are used to maintain constant fill levels, and some of the unusable bottles and all of the trimmings are recycled by the blow molder.

Recycling can be extended by:

1. Baskets around the blow molder to reduce plastic contamination to enable recycling.

2. Installation of a sensitive float in the reservoir of the fill machine to prevent overflow.

3. Addition of an apron or holding tank under the fill machine to catch overflow and recycle it back into the reservoir.

Chemical storage can be improved by:

1. Stock only chemicals currently in use

2. Provide permanent stationary stable storage areas.

3. Provide adequate spacing between incompatible chemicals.

4. Remove obsolete stock.

The air quality in the bottle making room and the windshield wiper fluid fill area should be checked for particulates and ammonia/methanol respectively to ensure they comply with State OSHA standards. Request assistance from the State Department of Labor. Voluntary Compliance Section (264-2599). Protective

clothing may be necessary when working with methanol. All new employees should be trained on the possible effects of the compounds they work around and what to do in case of an accident. Contingency plans need to be set up outlining the procedures to be followed in the event of a spill.

Emergency equipment should be present in the plant including but not limited to fire extinguishers, first aid kits, and eye wash stations. Care should be taken at the entrances and exits from the shop that the floors do not become slippery due to snow melt in the winter.

The majority of waste materials management options suggested in this report are relatively inexpensive and easy to implement. Savings of raw material and product would cover the costs of implementation in a very short time. Through this audit and the solutions presented herein it should be possible to increase the productivity of this plant.

It is strongly recommended that this company form a internal waste management team composed of workers and management to further evaluate and identify waste reduction opportunities. Moreover, this team would serve as a vehicle for measuring the success of any waste reduction option that is implemented.

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